

### Science Metrics: The Issues and New Approaches

Lane, Julia

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Lane, Julia

**Working Paper**

## Science Metrics: The Issues and New Approaches

RatSWD Working Paper, No. 159

**Provided in Cooperation with:**

German Data Forum (RatSWD)

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German Data Forum  
(RatSWD)

[www.germandataforum.de](http://www.germandataforum.de)

# RatSWD

## *Working Paper Series*

Working Paper

No. 159

### Science Metrics: The Issues and New Approaches

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Julia Lane

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September 2010

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Federal Ministry  
of Education  
and Research

## Working Paper Series of the German Data Forum (RatSWD)

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The *RatSWD Working Papers* series was launched at the end of 2007. Since 2009, the series has been publishing exclusively conceptual and historical works dealing with the organization of the German statistical infrastructure and research infrastructure in the social, behavioral, and economic sciences. Papers that have appeared in the series deal primarily with the organization of Germany's official statistical system, government agency research, and academic research infrastructure, as well as directly with the work of the RatSWD. Papers addressing the aforementioned topics in other countries as well as supranational aspects are particularly welcome.

*RatSWD Working Papers* are non-exclusive, which means that there is nothing to prevent you from publishing your work in another venue as well: all papers can and should also appear in professionally, institutionally, and locally specialized journals. The *RatSWD Working Papers* are not available in bookstores but can be ordered online through the RatSWD.

In order to make the series more accessible to readers not fluent in German, the English section of the *RatSWD Working Papers* website presents only those papers published in English, while the German section lists the complete contents of all issues in the series in chronological order.

Starting in 2009, some of the empirical research papers that originally appeared in the *RatSWD Working Papers* series will be published in the series *RatSWD Research Notes*.

The views expressed in the *RatSWD Working Papers* are exclusively the opinions of their authors and not those of the RatSWD.

The RatSWD Working Paper Series is edited by:

Chair of the RatSWD (2007/2008 Heike Solga; since 2009 Gert G. Wagner)

Managing Director of the RatSWD (Denis Huschka)

This paper documents the presentation slides of the 1st Distinguished Lecture of the German Data Forum (RatSWD), held on 15th September 2010 at the DIW Berlin.

# Science Metrics: The Issues and New Approaches

Julia Lane

This presentation represents the views of the author and not of the institution she represents.

## Overview

- Why Metrics Matter
- Conceptual Framework
  - The scientific challenge
  - The empirical challenge
- What's Being Done in the US: STAR METRICS
  - What it is
  - Structure
  - Measuring outcomes: The Role of Incentives
  - Examining impact: The Role of Social and Domain Scientists

# Why metrics matter

- **Government**
  - Advance basic science
  - Improve wellbeing of citizens
  - => Affects level of funding
- **Funding agencies**
  - Want to identify and fund good science
  - => Affects type of funding
- **Academic institutions**
  - Want to hire and retain good scientists
  - Want to demonstrate impact
  - => Affects who does science

## Administration Interest

- **Investment in Science**
  - American Recovery and Reinvestment Act
  - The National Academy of Sciences Speech, April 2009
- **Openness and transparency**
  - data.gov; open.gov; etc.
- **Evidence based policy**
  - Joint memo on “Science and Technology Priorities for the FY2012 Budget” : **Science of Science Policy** (is the only program listed by name – also in 2011)
- **Accountability**
  - ARRA Reporting Guidelines
  - Putting Performance First: Replacing PART with a new performance improvement and analysis framework



# Administration Interest

Agencies, in cooperation with OSTP and OMB, should develop and sustain datasets to better document Federal science, technology, and innovation investments and to make these data open to the public in accessible, useful formats. Agencies should develop and regularly update their data sharing policies for research performers and create incentives for sharing data publicly in interoperable formats to ensure maximum value, consistent with privacy, national security, and confidentiality concerns.

Agencies should develop outcome-oriented goals for their science, technology, and innovation activities, establish timelines for evaluating the performance of these activities, and target investments toward high-performing programs in their budget submissions. Agencies should support the development and use of “science of science policy” tools that can improve management of their R&D portfolios and better assess the impact of their science, technology, and innovation investments.

*FY12 Orszag-Holdren Memo, July 21 2010; reiterates August 4, 2009 memo;  
Science of Science Policy is only program mentioned by name*

# Congressional Interest





Most of the \$3 billion of National Science Foundation spending has gone to energy or climate-related research, or work in fields such as astronomy, chemistry and engineering. The agency is also supporting some social-science projects that are unlikely to reap economic rewards in the foreseeable future, such as the documentation of indigenous languages that are nearly extinct, including video recordings of Tlingit conversations in Alaska and analysis of the grammar of Hink, an Arizono dialect.

Spending on science is one of the best ways to generate jobs and economic growth, say research advocates. But as **Colin Macilwain** reports, the evidence behind such claims is patchy.

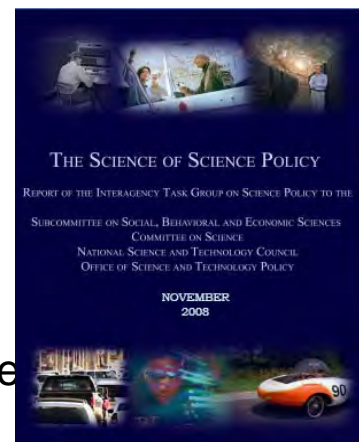
# Scientists Can Provide a 'Black Box' Answer



ROMAN AUGURS: Roman augurs foretell the future by observing the behavior of hens © Copyright (c) Mary Evans Picture Library 2007

## Or...Start To Develop A Scientific Framework

- Science of Science Policy Interagency Task Group
- The SoSP Roadmap
  - Published in November, 2008
  - Four guiding themes
  - Ten key questions
- December, 2008 Workshop
  - Engage the current community of practice
  - Interactive evaluation of Roadmap



# Research Challenge: Conceptual

Need to describe and measure the creation, transmission and adoption of knowledge

Table 1: Three Distinct Tasks Arising in the Analysis of Causal Models

Task	Description	Requirements
1	Defining the Set of Hypotheticals or Counterfactuals	A Scientific Theory
2	Identifying Causal Parameters from Hypothetical Population Data	Mathematical Analysis of Point or Set Identification
3	Identifying Parameters from Real Data	Estimation and Testing Theory

Heckman, 2008, Econometric Causality, NBER working paper 13934, 2008

## Research Challenges: Conceptual

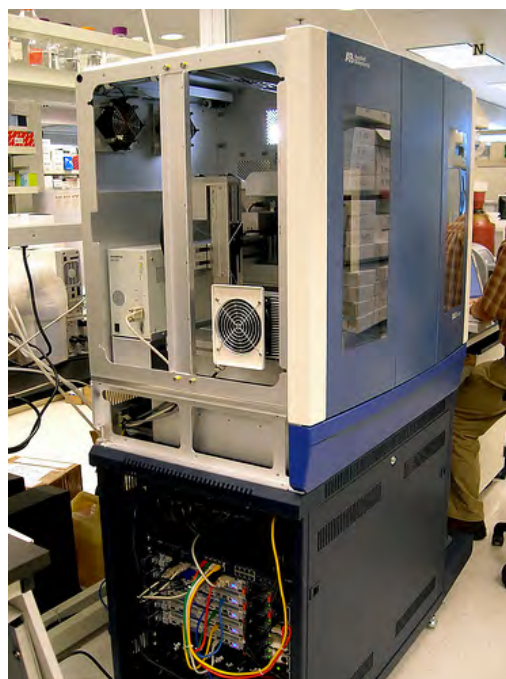
- How to describe creation of knowledge?
  - Unit of analysis
  - Input measures
- How to describe transmission?
  - Networks
  - Technology
- How to describe adoption?
  - Lags
  - Proximal causes
- What structural model?
  - Linear
  - Outcome measures
- Fundamental challenge: Establishing counterfactuals
  - Selection bias
  - Random assignment not an option



# Research Challenges: Empirical

- **Data Infrastructure**
  - Science agencies have balkanized proposal and award administration systems
  - Unit of analysis is awards – while appropriate unit is individuals
  - Typically limited data on postdocs, graduate students, undergraduate students
  - Limited data on subawards
  - Information captured only during funding period
  - Information typically captured manually, sporadically and in unstructured format
  - Outputs not linked to inputs or infrastructure investments in a systematic way.
  - Data not captured on people who DON'T get funded, so difficult to establish counterfactual
- **Heterogeneous sources of outcomes**
- **Changing nature of scientific communication**
- **Scientific Attribution**
  - Name disambiguation
  - Global enterprise

If we can automate the DNA sequencing, we can describe science investments!



# STAR METRICS

Science and Technology in America's Reinvestment –  
Measuring the EffectS of Research on Innovation,  
Competitiveness and Science

## What is STAR METRICS?

1. Data Infrastructure to capture impact of science investments.
2. Collaborative identification of data and data sources
3. Explicit integration of domain and social scientists in development of metrics

# Basic Approach

## Creating the Frame

- Start with basic unit of analysis
  - Science is done by scientists. Need to identify universe of individuals funded by federal agencies (PI, co-PI, RAs, graduate students etc.)
- Capture Inputs using existing data

## Measuring outcomes

- Scientific
- Social
- Economic
- Workforce

## Creating the Frame

Academic Grantee Institutions



Federal S&T Funding Agencies

# Based on Existing Record Reporting

UIA 1017 (Rev. 1-06)

**Wage Detail Report**

STATE OF MICHIGAN, DEPARTMENT OF LABOR & ECONOMIC GROWTH  
UNEMPLOYMENT INSURANCE AGENCY

Authorized by  
MCL 421.1, et seq.

PICA ELITE  
☐ ☐

BY USING "ALIGNMENT BOXES" TYPED & LINE PRINTED DATA WILL FALL WITHIN ALL FIELDS

Report Quarter Ending:  Return by:

Mail original form to:  
(Do not mail a copy)

**RESET FORM**

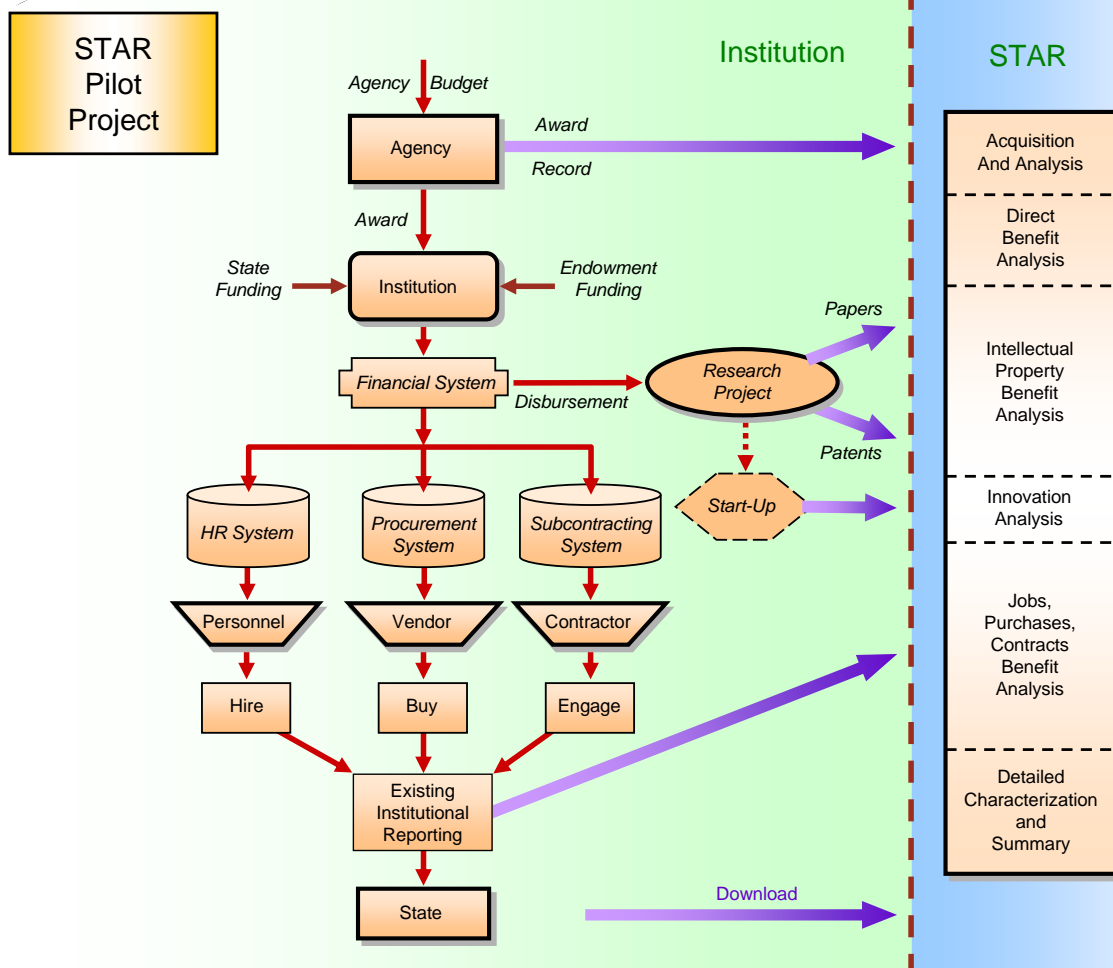
UIA Wage Record Unit  
P.O. Box 9052  
Detroit, MI 48202-9052  
1-313-456-2760  
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FEIN

UIA Account Number  Multi-Unit

Please Type Or Print All Information

STATUS	DELETE (X)	SOCIAL SECURITY NUMBER	EMPLOYEE NAME		GROSS WAGES PAID THIS QUARTER
			LAST NAME	FIRST NAME	
					\$
					\$
					\$
					\$
					\$
					\$
					\$



# Creating the Frame (and measuring jobs)



## Data Elements

**14 administrative data elements from awards, grants, HR or finance systems are provided to STAR Metrics on a quarterly basis...**

- Award data
- Payroll Staff Information
- Non-Payroll Charges
- Sub-awards
- Indirect Cost Rate Proposal

**...will yield these Quarterly pre-calculated reports...**

- **Stimulus FTE Jobs (ARRA)** – with and without Overhead Job calculations
- **FTE Jobs and Positions** – All awards (with and without Overhead)
- **FTE Sub-awards** – All awards (with and without Overhead)
- **Vendor FTE's (Jobs)** – All awards
- **Overhead Jobs** (calculated from Indirect Costs)

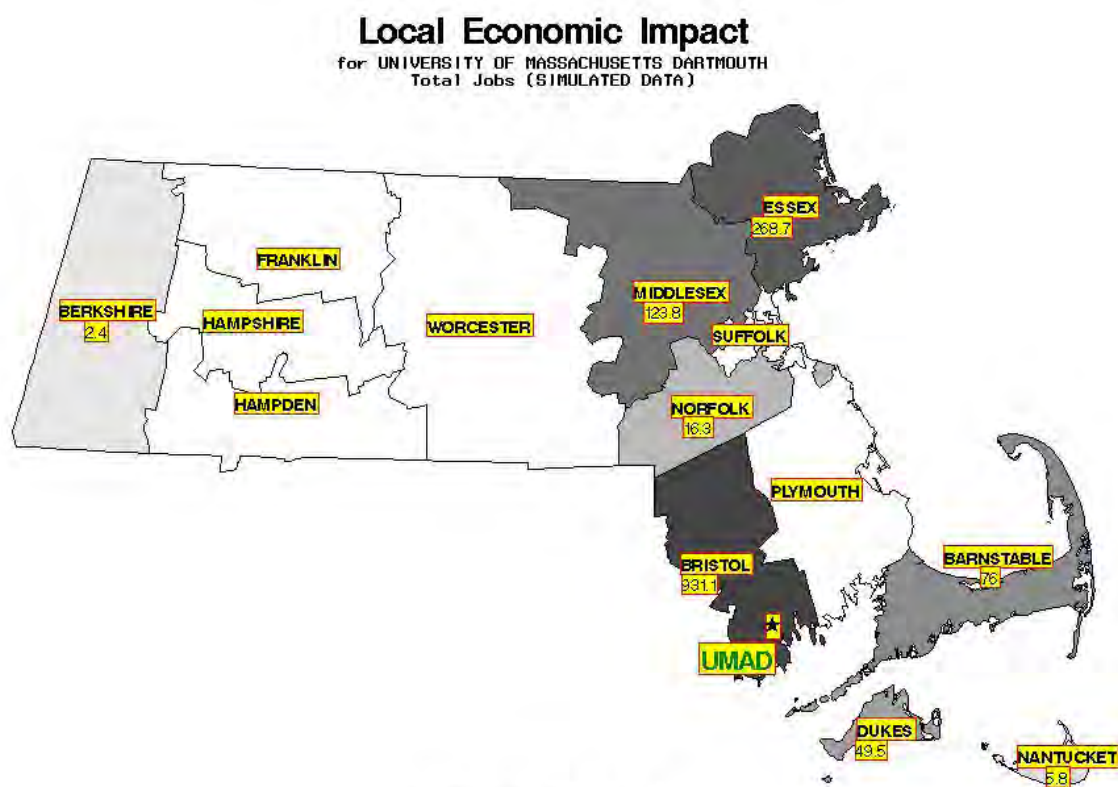


# Star Metrics Phase 1 – 14 Requested Data Elements

Description	Element ID	Item	Data Source	Unit of Analysis	Purpose
Information on Scientists and Awards	1	De-identified Employee ID #	University	Individual	Job Metrics
	2	Federal Award ID #		Award	
	3	University Award ID #		Award	
	4	Overhead charged		Award	
	5	Occupational Classification		Individual	
	6	Proportion of time allocated to award		Individual	
	7	FTE status		Individual	
Information on Overhead	8	Proportion of overhead associated with salaries (from overhead cost proposal)	University	University	Job Metrics
Payments to vendors	2	Federal Award ID #	University	Award	Secondary Economic Impact
	9	University Award ID #		Award	
	10	Duns #		Vendor	
	11	Amount of Contract		Vendor	
Subcontracts and subawards	2	Federal Award ID #	University	Award	Secondary Economic Impact
	12	University Award ID #		Award	
	13	Duns #		Subcontractor	
	14	Amount of Contract		Subcontractor	

STAR METRICS

9/23/2010



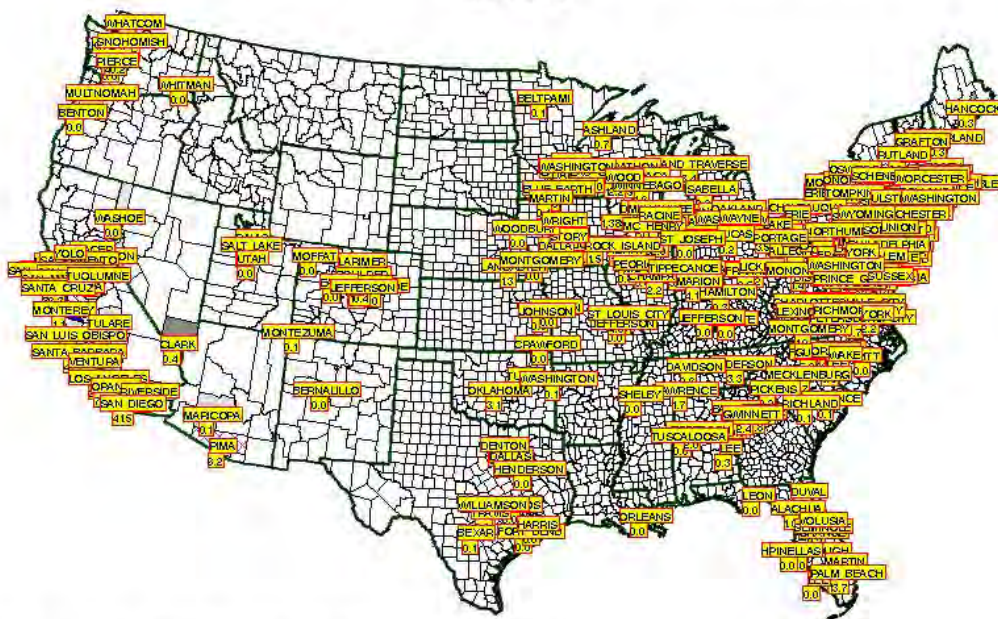
Source: STAR Metrics - Jobs

**Local Economic Impact  
for UNIVERSITY OF MASSACHUSETTS  
DARTMOUTH  
Total Jobs (SIMULATED DATA)**

County Name	County Code	Sub-Awards & Vendor Jobs	Award FTEs, Sub-Award & Vendor Jobs	Total Jobs
BARNSTABLE	1	76	76	76
BERKSHIRE	3	2.4	2.4	2.4
BRISTOL	5	100.7	861.4	931.1
DUKES	7	49.5	49.5	49.5
ESSEX	9	268.7	268.7	268.7
MIDDLESEX	17	123.8	123.8	123.8
NANTUCKET	19	5.8	5.8	5.8
NORFOLK	21	16.3	16.3	16.3
		643	1,404	1,474

Source: STAR Metrics - Jobs

**Initial Jobs Impact of Science Expenditures  
for 5 universities  
Total Jobs**



Source: STAR Metrics - Jobs Q3 2009 - Q2 2010 (fuzz factor applied)  
Note: Map excludes Alaska, Hawaii, and Puerto Rico.

# Measuring Outcomes: The Role of Incentives

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1. Reduce Burden
2. Leverage Existing Data
3. Describe Impact





# Reducing Burden: Use Existing Reports

**NATIONAL SCIENCE FOUNDATION**

**Agency Information Collection Activities: Comment Request**

**AGENCY:** National Science Foundation (NSF).

**ACTION:** Submission for OMB Review; Comment Request and Final Notice of a Uniform Research Performance Progress Report (RPPR) format.

**SUMMARY:** Effective with publication of this Notice in the **Federal Register**, agencies will be able to utilize a new uniform format for reporting performance progress on Federally-funded research projects. The Research Performance Progress Report (RPPR) will directly benefit award recipients by making it easier for them to administer Federal grant and cooperative agreement programs through standardization of the types of information required in interim performance reports—thereby reducing their administrative effort and costs. The RPPR will also make it easier to compare the outputs, outcomes, etc. of

develop an agency- or program-specific component, if necessary, to meet programmatic requirements, although agencies should minimize the degree to which they supplement the standard components. Such agency- or program-specific requirements will require review and clearance by OMB.

Agencies also may use other OMB-approved reporting formats, such as the Performance Progress Report (PPR), if those formats are better suited to the agency's reporting requirements, for example, for research centers/institutes, clinical trials, or fellowship/training awards or in connection to reporting on program performance, through mechanisms such as the Performance Assessment Rating Tool.

On behalf of the RBM Subcommittee, the National Science Foundation (NSF) has agreed to serve as sponsor of this new format. We anticipate this being the final notice before the format and instructions are finalized. The general public and Federal agencies, however, are invited to comment on the proposed final format during the 30 day public comment period. The Government-wide RPPR is posted on the NSF Web site at: [www.nsf.gov](http://www.nsf.gov), which is accessible 24 hours a day, 7 days a week, 365 days a year (including Federal holidays).

We encourage respondents to submit comments electronically to ensure timely receipt. We cannot guarantee that comments mailed will be received before the comment closing date. Please include "Research Performance Progress Reporting" in the subject line of the e-mail message; please also include the full body of your comments in the text of the message, and as an attachment. Include your name, title, organization, postal address, telephone number, and e-mail address in your message.

**FOR FURTHER INFORMATION CONTACT:** For information on the RPPR, contact Jean Feldman; Head, Policy Office, Division of Institution & Support; National Science Foundation; 4201 Wilson Blvd; Arlington, VA 22230; e-mail: [jfeldman@nsf.gov](mailto:jfeldman@nsf.gov); telephone: (703) 292-8243; fax: (703) 292-9171.

For further information on the NSTC RBM Subcommittee, contact Diane DiEuliis, at the Office of Science and Technology Policy, 725 17th Street, NW., Washington, DC 20503; e-mail: [ddieuliis@ostp.eop.gov](mailto:ddieuliis@ostp.eop.gov); telephone: 202-

# Reducing Burden: The Brazilian Experience

Ministério da Ciência e Tecnologia

CNPq  
Conselho Nacional de Desenvolvimento Científico e Tecnológico

23/11/2009  
New version of Lattes Database Launched

- CNPq signs agreement with Thomson Reuters
- Agreement with the Federal Revenue of Brazil
- Collaboration Network

Lattes Database is a Curriculum and institutions database of Science and Technology areas in Brazil.

More info

SCOPUS  
ISI WEB OF KNOWLEDGE  
SciELO  
JCR  
Browsed by  
SJR  
CrossRef  
Scopus

Researchers and Students

- Search CV
- Update CV
- Register

Education and Research Institutions and Companies

- Search
- Update
- Register

FAQ | Institutional Agreements | Data and Statistics | Contact | Other Database

Site Stats

Copyright CNPq 2008

## BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2. Follow this format for each person. DO NOT EXCEED FOUR PAGES.

NAME Michael Conlon	POSITION TITLE Interim Director of Biomedical Informatics, University of Florida
68A COMMONS USER NAME MCONLON	
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)	
INSTITUTION AND LOCATION	DEGREE (if applicable)
Bucknell University, Lewisburg, PA	B.A.
Bucknell University, Lewisburg, PA	B.A.
University of Florida, Gainesville, FL	M.Stat
University of Florida, Gainesville, FL	Ph.D.
	YEARS
	1975
	1975
	1979
	1982
	FIELD OF STUDY
	Mathematics
	Economics
	Statistics
	Statistics

## A. Positions and Honors

## Positions and Employment

2008- Interim Director, Biomedical Informatics, College of Medicine, University of Florida.  
 2008- Associate University CIO, IT Architecture  
 2008- Associate Director, Clinical and Translational Science Institute, University of Florida.  
 2008- Interim Director, Clinical and Translational Informatics Program, University of Florida  
 2008- Research Associate Professor, Department of Epidemiology and Health Policy Research, University of Florida  
 2005-08 PeopleSoft Implementation Officer, University of Florida  
 2002- Director of Data Infrastructure, University of Florida  
 2002-03 Co-founder and Chief Technology Officer, MarCon Global Data Solutions, Incorporated  
 1997-02 Assistant Vice President for Health Affairs, Academic Information Systems and Support and Chief Information Officer, University of Florida Health Science Center  
 1993-07 Director of Information Resources and Technology Programs, College of Liberal Arts and Sciences, University of Florida  
 1992-08 Research Associate Professor, Department of Statistics, University of Florida  
 1982-83 Asst. Dir. of Acad. Computing, Ctr for Instr. and Research Computing Activities, Univ. of Florida  
 1980-83 Director, Statistical Consulting Center, Center for Instructional and Research Computing Activities

## Other Experience

2009- Member, InCommon working group on Research Administration  
 2008- Chair, Health Science Center Information Architecture Committee  
 2008- Member, Health Science Center Information System Advisory Council  
 2008-09 Chair, University Planning Group on Computational Biology  
 2007-08 Member, Health Science Center Information Architecture Committee  
 2004- Member, Educause Working Group on Identity Management  
 2003- Chair, Information Technology Advisory Committee on UF Active Directory  
 2003-05 Editor, AmStat OnLine, American Statistical Association  
 2002- Member, Information Technology Advisory Committee, Data Infrastructure and Administrative Computing  
 2002-03 Chair, University Directory Services Committee  
 2001-03 Member, Microsoft national Higher Education Advisory Group

PHS 2982590 (Rev. 08/04)

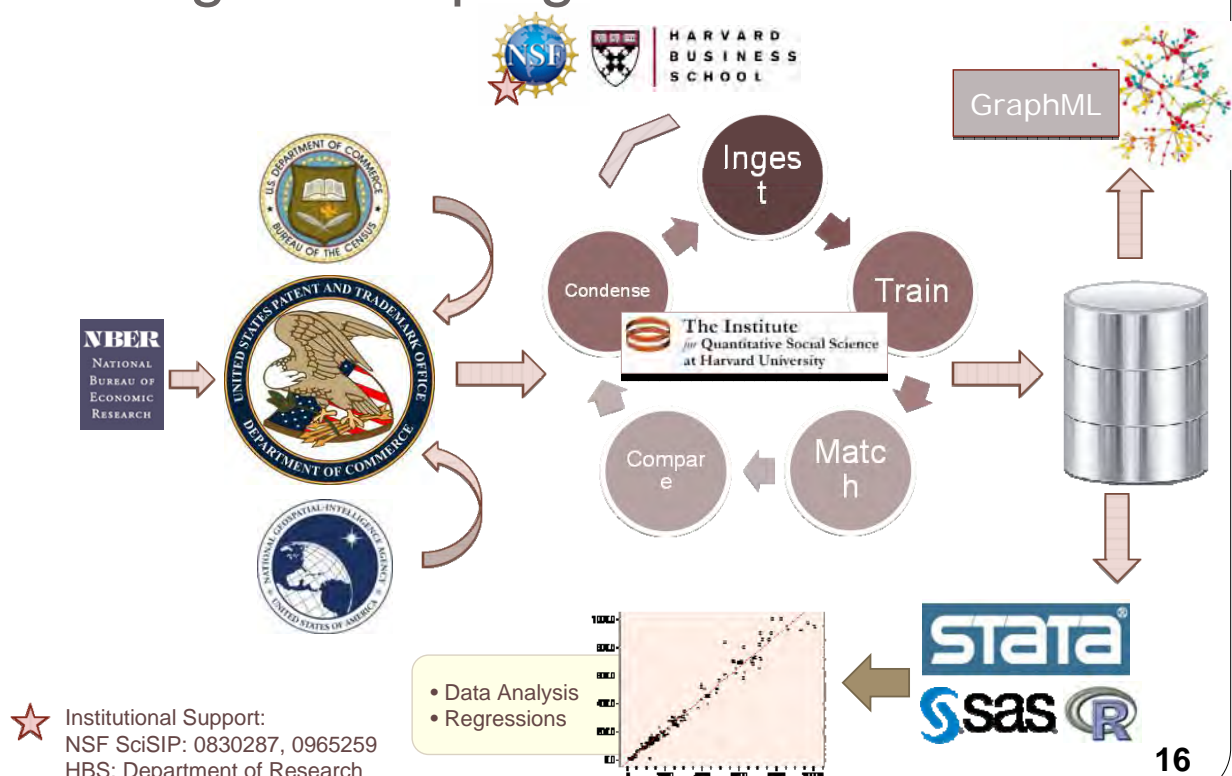
Page \_\_\_\_

Biographical Sketch Format Page

# “Facebook for Scientists”

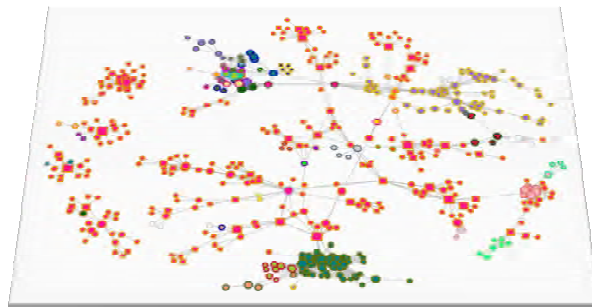
- Information in VIVO can be used to create
  - Biosketches
  - Vitas
  - Annual reports
  - Department and research group web sites
- Information can be used to populate profiles in collaborative tools – portals, wikis, ...

## Leverage Existing Data: e.g. Developing Patent Database





# Visual Exploration - Overview



## Top Assignees - (501 inventors)

WISCONSIN ALUMNI RESEARCH FOUNDATION	(274)
PROMEGA CORPORATION	(55)
THIRD WAVE TECHNOLOGIES INC.	(51)
TOMOTHERAPY INCORPORATED	(48)
ERAGEN BIOSCIENCES INC.	(46)
STANDARD SMITH INC.	(17)
ACTUANT CORPORATION	(16)
VERISTE LLC	(15)
JOHNSON DIVERSEY INC.	(10)
RENDAR INC.	(4)

## Primary Class - (471 patents)

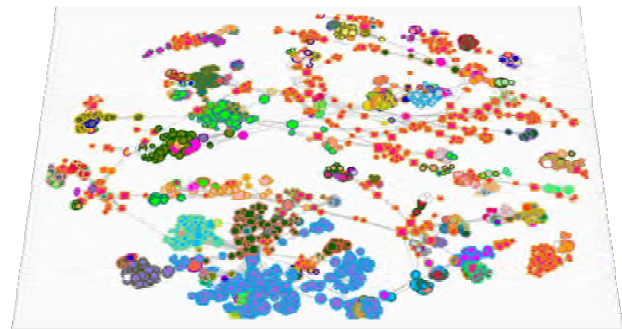
435 (147) CHEMISTRY MOLECULAR BIOLOGY AND MICROBIOLOGY
534 (51) DRUG BIO-AFFECTING AND BODY-TREATING COMPOSITIONS
307 (20) EQUIPMENT FOR PREPARING OR SERVING FOOD OR DRINK NOT ELSEWHERE SPECIFIED
324 (17) ELECTRICITY MEASURING AND TESTING
250 (13) RADIANT ENERGY
378 (13) X-RAY OR GAMMA RAY SYSTEMS OR DEVICES
800 (11) SURGERY
362 (8) IMAGE ANALYSIS
372 (8) COHERENT LIGHT GENERATORS
576 (6) ORGANIC COMPOUNDS PART OF THE CLASS 532 570 SERIES

## Top Assignees - (1822 inventors)

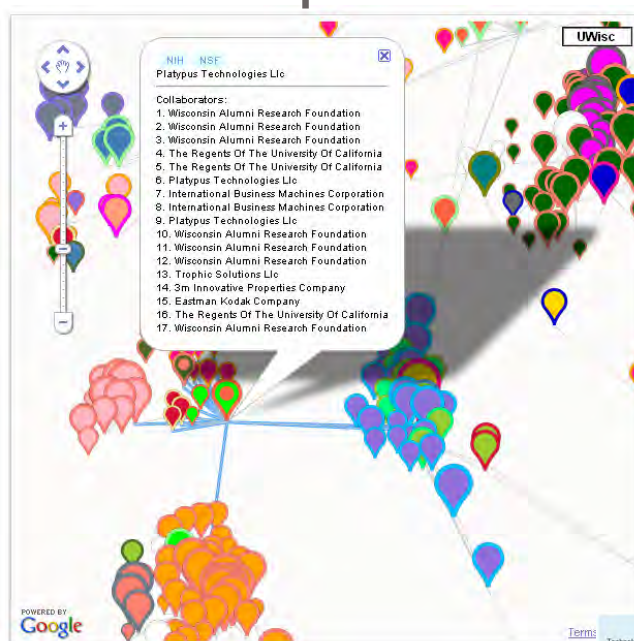
WISCONSIN ALUMNI RESEARCH FOUNDATION	(391)
INTERNATIONAL BUSINESS MACHINES CORPORATION	(123)
GENERAL ELECTRIC COMPANY	(72)
EMC CORPORATION	(59)
SUN MICROSYSTEMS INC.	(54)
THIRD WAVE TECHNOLOGIES INC.	(52)
PIONEER HERED INTERNATIONAL INC.	(40)
PFIZER INC.	(39)
EASTMAN KODAK COMPANY	(36)
PHARMACIA CORPORATION	(18)
ELAN PHARMACEUTICALS INC.	(14)

## Primary Class - (2847 patents)

514 (286) DRUG BIO-AFFECTING AND BODY-TREATING COMPOSITIONS
435 (258) CHEMISTRY MOLECULAR BIOLOGY AND MICROBIOLOGY
379 (208) X-RAY OR GAMMA RAY SYSTEMS OR DEVICES
600 (164) MULTICELLULAR LIVING ORGANISMS AND UNIMODIFIED PARTS THEREOF AND RELATED PROCESSES
347 (179) INCREMENTAL PRINTING OF SIMULATED INFORMATION
CHEMISTRY NATURAL RESINS OR COMBINATIONS THEREOF
530 (93) PEPTIDES OR PROTEINS LIVING OR REACTION PRODUCTS THEREOF
711 (87) ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS
709 (77) ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS
373 (74) PULSE OR DIGITAL COMMUNICATIONS
424 (70) DRUG BIO-AFFECTING AND BODY-TREATING COMPOSITIONS



# Visual Exploration - Drill Down



## Lecturer at UW-Platteville

Madison, Wisconsin Area

Biochemistry

Current	• Lecturer at UW-Platteville
Past	• Sr. Project Manager at Promega • Director, Product R&D at Platypus Technologies • Sr. Process Development Manager at Abbott Laboratories
Education	• University of Wisconsin-Madison
Connections	18 connections
Public Profile	<a href="http://www.linkedin.com/pub/bug-hanawalt/10/456/a89">http://www.linkedin.com/pub/bug-hanawalt/10/456/a89</a>

## Associate at W L G

Greater Philadelphia

Current	• Public Profile
Past	
Education	• University of Wisconsin-Madison • University of California, Davis • University of California, Santa Barbara
Connections	34 connections
Website	• My Website
Public Profile	<a href="http://www.linkedin.com/pub/justin-skala/47/755/10">http://www.linkedin.com/pub/justin-skala/47/755/10</a>

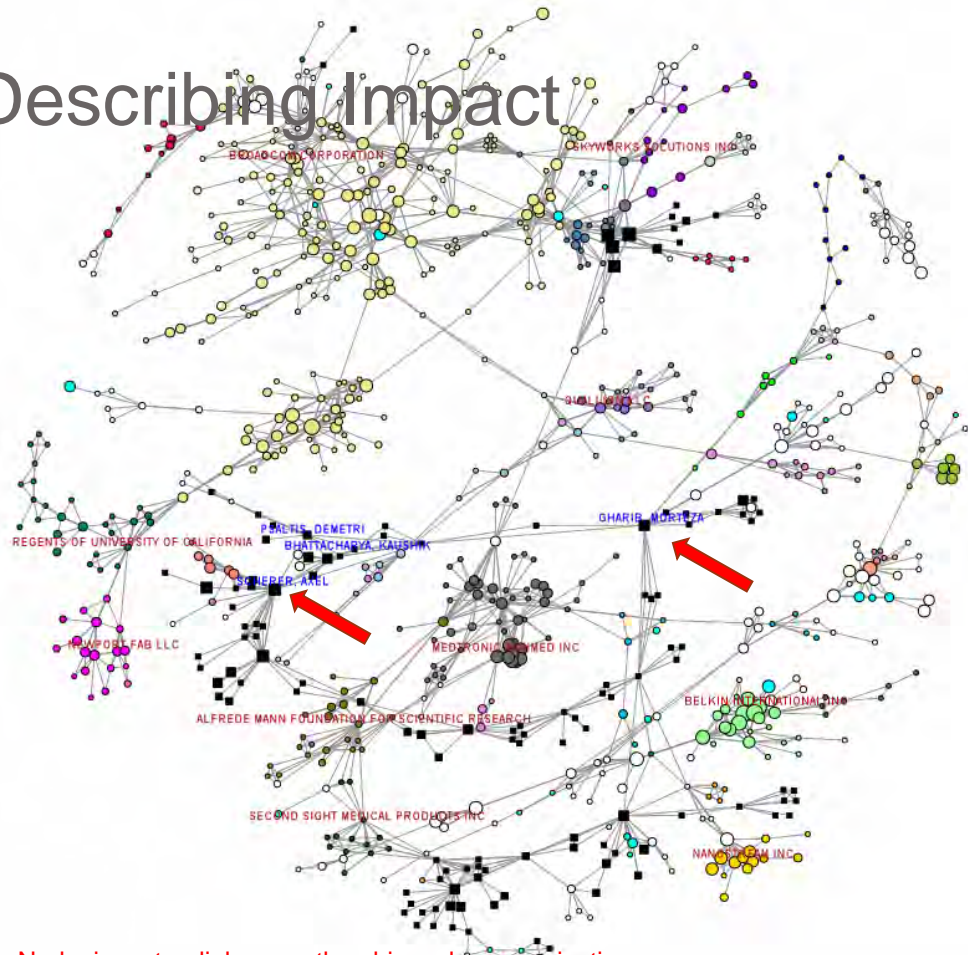
## Technologist at W L G

Greater Philadelphia Area

Current	• Public Profile
Past	
Education	• University of Wisconsin-Madison • University of California, Davis • University of California, Santa Barbara
Connections	34 connections
Website	• My Website
Public Profile	<a href="http://www.linkedin.com/pub/justin-skala/47/755/10">http://www.linkedin.com/pub/justin-skala/47/755/10</a>

# Describing Impact

- **Broadcom:** networking and communications ICs for data, voice, and video applications
- **Medtronic**
- **Univ. of California**
- **Belkin Int'l:** computer connectivity hardware
- **Second Sight:** retinal prosthesis (cybernetic eyeglasses)
- **Alfred Mann Foundation:** funds medical device research



Node: inventor; link: co-authorship; color: organization

## Describing Impact

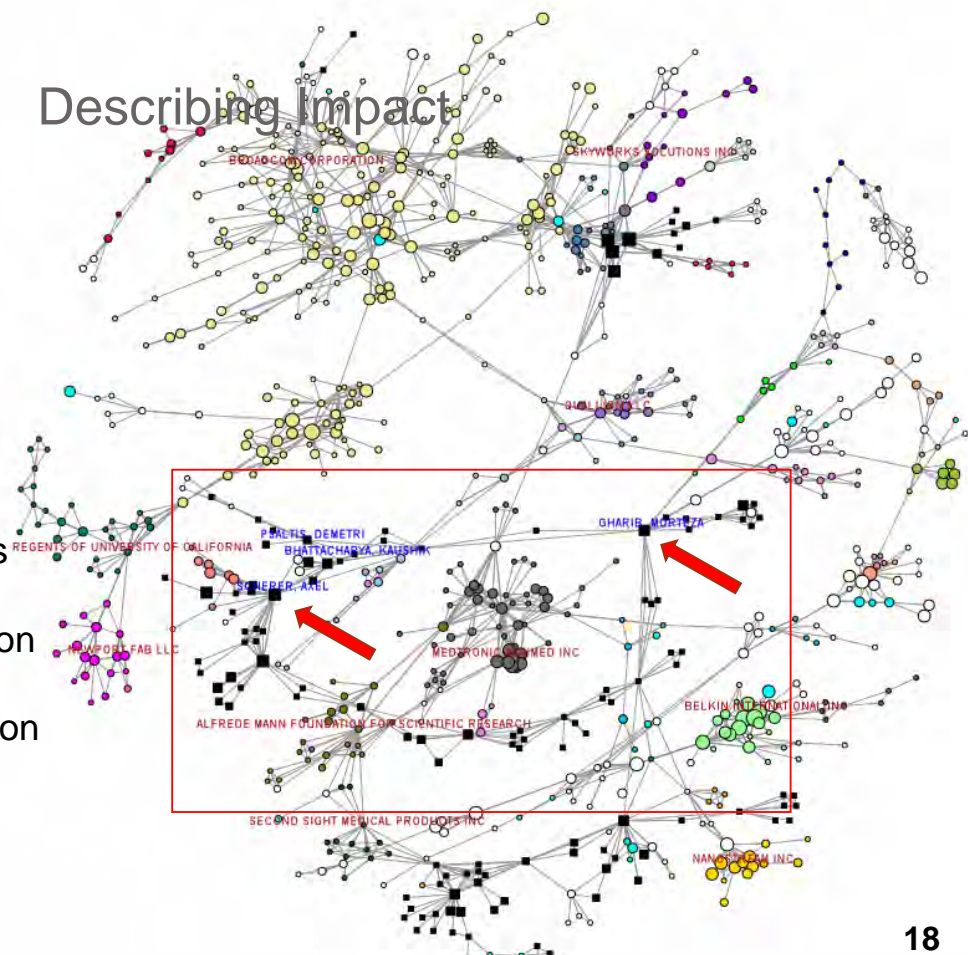
1. Knowledge Diffusion  
Three links out

(Singh 2005)

2. Sources of Links

- Student graduation
- Inventor mobility
- Direct collaboration

(Fleming 2007)



Node: inventor; link: co-authorship; color: organization



# Capturing Outcomes



Scientists create tags on their websites, collaborate through VIVO, or register through a LATTES like process

New approaches discussed and validated with FDP

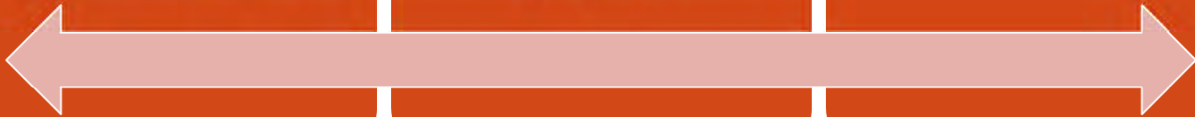


## STAR METRICS

1. Inhales information from scientists
2. Creates Progress Report for scientists to validate
3. Exhales information to agency reports



Agencies identify fields that can be inhaled from STAR METRICS



## Practical Application

### **Accelerating Innovation Research (AIR)**

#### **PROGRAM SOLICITATION** **NSF 10-608**



National Science Foundation  
Directorate for Engineering  
Industrial Innovation and Partnerships

**Letter of Intent Due Date(s) (required)** (due by 5 p.m. proposer's local time) :

December 01, 2010

**Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time).

February 01, 2011



**D. Project Description:**

Cannot exceed 15 pages, and must include the following:

- How the partnership will enable innovation that neither party could do as well or rapidly alone.
- How the partnership leverages the research and technology of the research alliance to accelerate innovation.
- How the partnership is expected to impact the development of an innovation ecosystem.
- A strategic plan and milestone chart with specific tasks and deliverables.
- Information on management and staffing.
- An assessment plan that will gauge the success of the partnership in creating an innovation ecosystem that includes the development of and justification for appropriate metrics. Proposers participating in the OSTP/NSF/NIH Federal Demonstration Partnership's STAR METRICS program, ([http://sites.nationalacademics.org/PGA/fdp/PGA\\_057189](http://sites.nationalacademics.org/PGA/fdp/PGA_057189)) are encouraged to contact their institutional representatives to identify ways in which the program could support this requirement.
- An education plan that shows how participating students will learn about innovation, entrepreneurship, and technology translation process.

**Option 1 and Option 2 Assessment**

OMB/OSTP Memorandum M-09-27 directed science and technology agencies to describe the expected outcomes from their research in relation to these four practical challenges and cross-cutting areas, providing quantitative metrics where possible, and describe how they plan to evaluate the success of various techniques to increase support for high-risk research.

In compliance with this memorandum, each annual and final project report should provide an explanation of the quantitative and qualitative metrics that have been used in evaluating the impact of their activities.

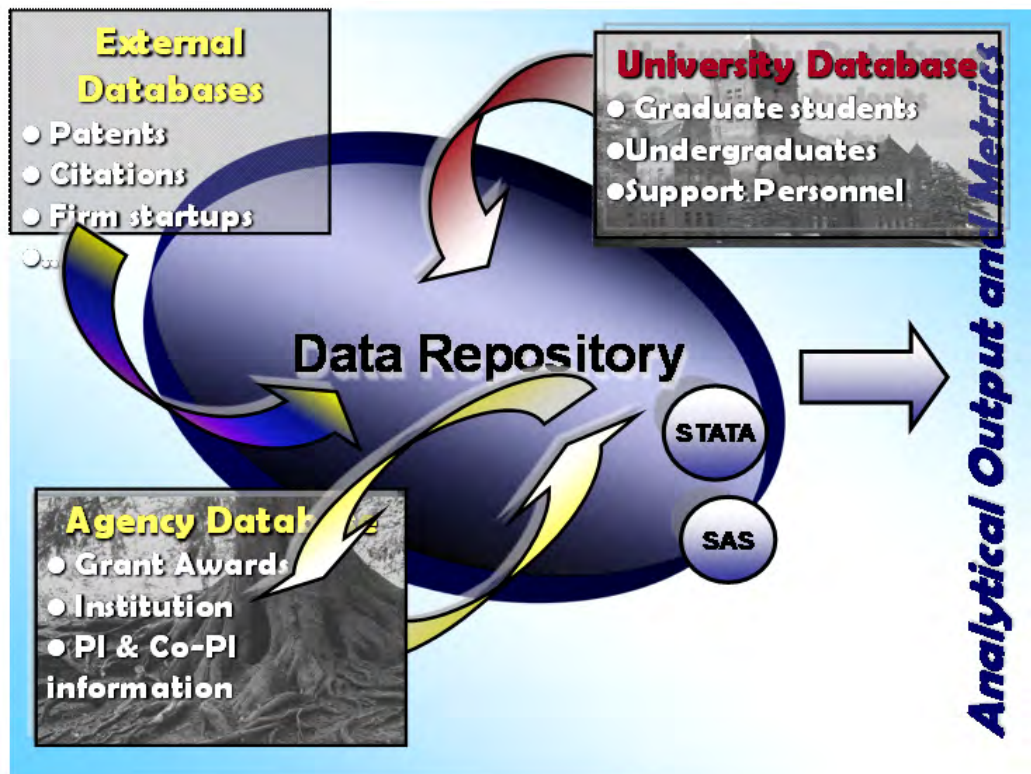
In order to reduce reporting and administrative burden, proposers are encouraged to use administrative records where possible. Universities participating in the OSTP/NIH/NSF/Federal Demonstration Partnership's (FDP) STAR METRICS program ([http://sites.nationalacademies.org/PGA/fdp/PGA\\_057189](http://sites.nationalacademies.org/PGA/fdp/PGA_057189)) are encouraged to contact their institutional representatives to identify ways in which the program could support the evaluation of their activities.

The report should be filed in the activities and findings section of the annual and final reports.

## Current Status

- NIH, NSF and OSTP MOU signed, DOE and EPA joining
- Partnership with Federal Demonstration Partnership, and engagement with AAU, APLU, COGR
- Over 100 academic institutions at various degrees of participation
- European Union engagement and emulation

# Developing Metrics: Engage Domain and Social Scientists



## What does this entail?

- Partner with PIs to
  - develop flow-based annual and final reports/biosketches
    - <http://ideas.repec.org/e/pla36.html>
    - <http://citeseerx.ist.psu.edu/>
  - Visualizations of networks and impact
  - Collaborative tagging of research outputs etc....
- Partner with university administrators to develop flow-based impact of science funding

## Ultimate Goals for Development of Science Metrics

- Fully fledged academic field
- Fully fledged analytical tool set in government:  
Science policy in same analytical tier as tax policy
- Common, automated, empirical infrastructure available to all universities and science agencies to quickly respond to State, Congressional and OMB requests
- Incentive compatible structure
- Common scientific infrastructure for researchers to develop and study science metrics

## Why metrics matter

- You can't manage what you can't measure
- And what you measure is what you get